Section 4.2

Relations and Functions

Curriculum Outcomes	Related Activities	Page in Text
• explore and apply functional relationships and notation, both formally and informally	• introduce and explore functions given their graphs	164
• graph by constructing a table of values, by using graphing technology, and when appropriate, by intercept-slope method	• Understand the connection between a function and a relation using cause-and-effect relationships	165
	• develop a test to determine quickly whether the graph of a given relation is a function	171

Jan 27-8:37 PM

Freda has joined four of her friends in a fitness group during her gym class. Their improvement in running capacity is being tested every Friday. In addition to regular training, they also jog 20 minutes in preparation for the Friday test. For five weeks, Freda's group has recorded how far each runner can go in a seven-minute run during gym class.

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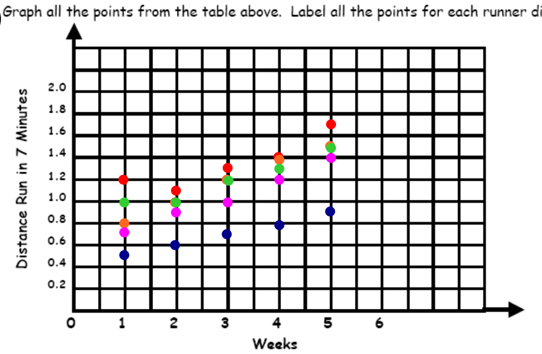
The gym teacher was interested in the relationship between the number of weeks of jogging and running capacity. As capacity is estimated by the distance run in seven minutes, the distances run in seven minutes were recorded each Friday for five weeks.

FREDA'S GROUP

Week	Feda (km)	Vanila (km)	Liz (km)	Tracy (km)	Ruth (km)
1	0.5	1.2	0.8	0.75	1.0
2	0.6	1.1	1.0	0.9	1.0
3	0.7	1.3	1.2	1.0	1.2
4	0.8	1.5	1.4	1.2	1.3
5	0.9	1.7	1.5	1.3	1.5

Questions

A Graph all the points from the table above. Label all the points for each runner differently.



B

It appears that there is a relationship: as the girls participate in consistent, regular exercise over time, their running capacity improves, and each week they can run farther in 7 minutes.

Feb 1-12:32 PM

#1 Predict how far each member of the group will run in week 6. Explain how you made your prediction.

Freda: 1.0 km
Vanita: 1.9 km
Liz: 1.7 km
Tracy: 1.6 km
Ruth: 1.6 km

Predict how far Vanita will run in seven minutes during week 10. Explain, with reference to domain and range, whether your answer is reasonable.

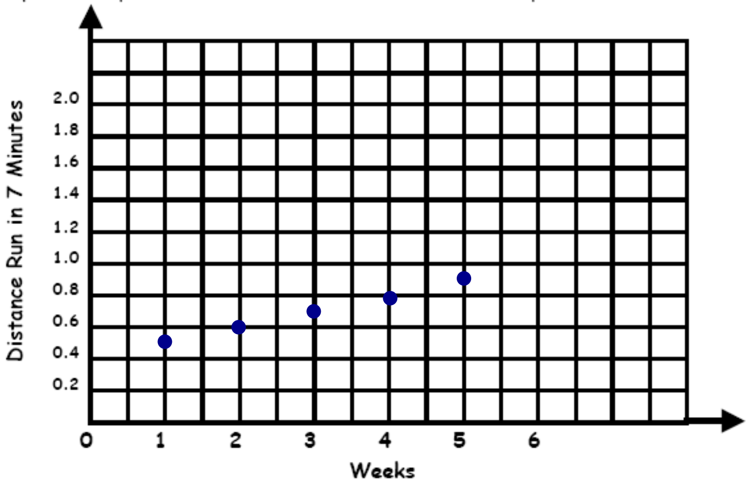
- You will need to extend your graph to find the distance Vanita could run in seven minutes after 10 weeks of jogging.
- This is called "extrapolation": predicting values outside the data. This value is not always accurate, and you must evaluate your answer to determine if it actually makes sense and is possible.
- For example, Vanita's body strength will not allow her distance run to continue to increase forever.
- In this case the domain and range need to be defined for a reasonable prediction to be made.

- **The graph suggests that she will be able to run 2.6 km in 7 minutes. That's faster than riding a bicycle.**
- **This continuous increase in distance run is NOT possible so the prediction is not reasonable.**
- **Reliability diminishes the further and further you move away from the data.**

Feb 1-12:33 PM

Questions

1) Graph all the points from the table above. Label all the points for each runner differently.



5) Compare the graph in 1) to the graph in 4). Explain why Freda's graph is a functional relationship, whereas the group's graph is not.

Freda's graph is a linear function; increasing at a constant rate.

The graphs of the others are not considered to be a "function"

Feb 1-12:34 PM

<u>Classwork/Homework</u>

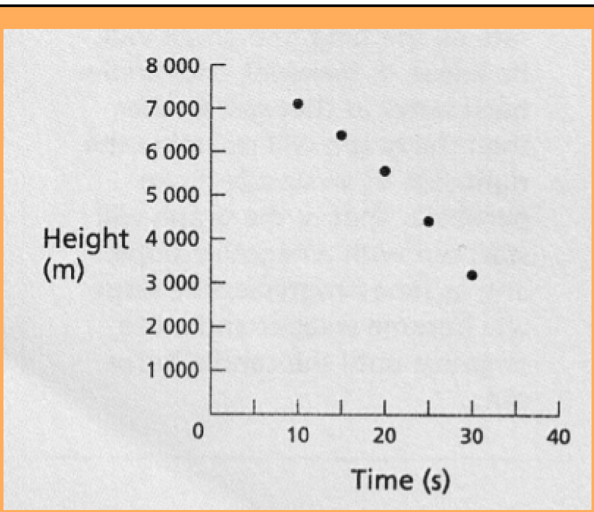
Page 168 # 8 and 9

For #9 you will need to draw the line of best fit and determine the equation of a line (y = mx + b)

<u>Remember</u>, in order to find the eqn. of a line:
-find the slope (m) using two points
-find the y-intercept (b)

Jan 27-5:10 PM

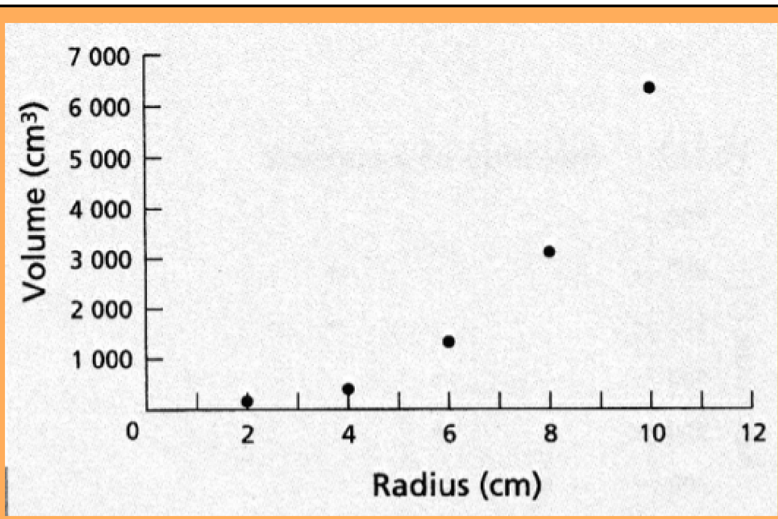
8a)



- The graph represents a function as there is only one y value for each x value.
- The graph is non-linear

Jan 28-8:43 AM

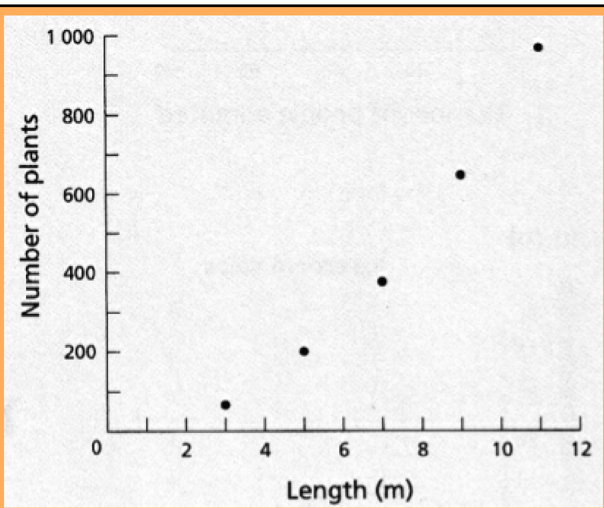
8b)



- The graph represents a function as there is only one y value for each x value.
- The graph is non-linear

Jan 28-8:43 AM

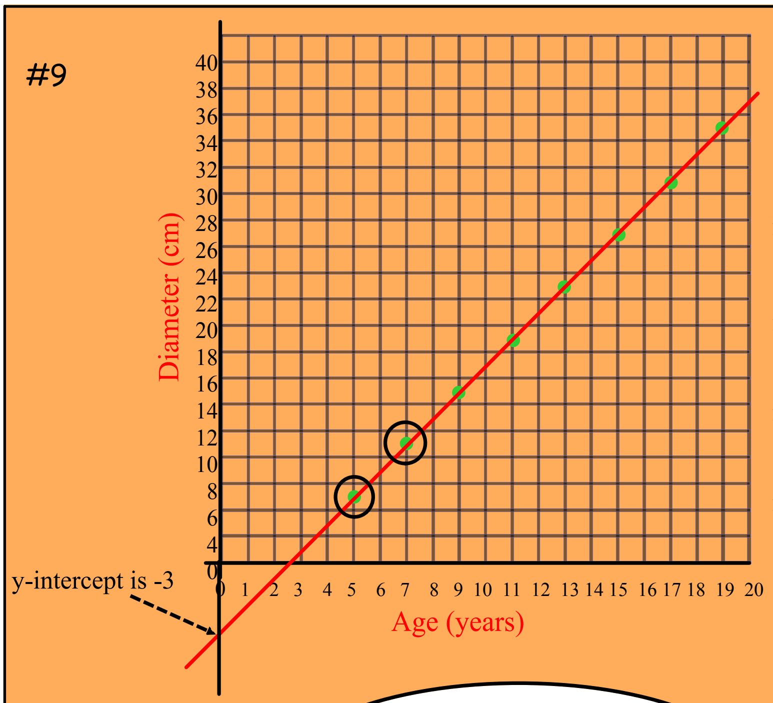
8c)



- The graph represents a function as there is only one y value for each x value.
- The graph is non-linear

Jan 28-8:45 AM

#9



Slope (m):

$m = \frac{y_2 - y_1}{x_2 - x_1}$

$m = \frac{11-7}{7-5}$

$m = \frac{4}{2}$

$m = 2$

Equation of the line (y = mx +b):

y = 2x - 3

Feb 1-2:15 PM

Modelling Functions

- A function is a special relationship between 2 variables in which there is only one dependent value for each independent value (1 'x' for each 'y' value)

- You are used to dealing with functions, as every equation you have ever seen is a function.

Example:

X	1	2	3	4	
Y	2	4	6	8	This relationship **IS** a function

X	2	2	3	4	
Y	1	2	4	6	This relationship **IS NOT** a function

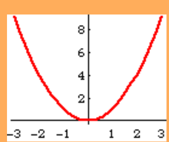
There are 3 ways to express a function:

1. As a Table of Values

x	**1**	**2**	**3**	**4**
y	**1**	**4**	**9**	**16**

2. As an Equation: the function of $y = x^2$ can be written as $f(x) = x^2$

3. As a graph: plot y = f(x) on a pair of coordinate axes; here's $\mathbf{y = x^2}$.



Feb 1-1:15 PM

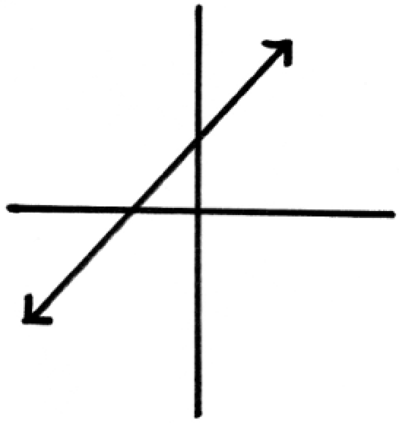
Before we begin....A Reminder:

Domain - All the possible x values
Range - All of the possible y values

We will be talking about 3 different types of functions:

Linear Function: $y = mx + b$

Domain: $x \in \mathbb{R}$
Range: $y \in \mathbb{R}$



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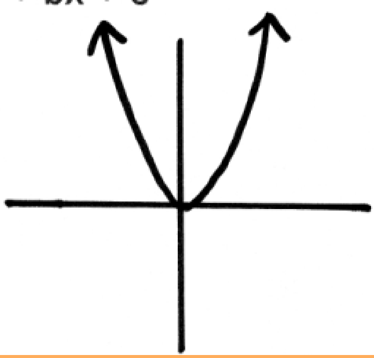
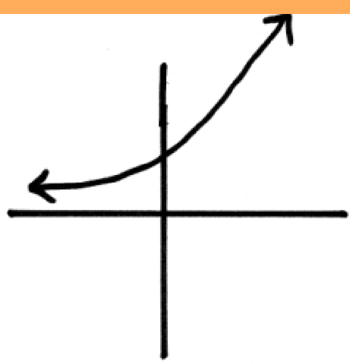
Quadratic Function: $y = ax^2 + bx + c$

Domain: $x \in \mathbb{R}$
Range: $y \geq 0$



Exponential Function: $y = a^x$

Domain: $x \in \mathbb{R}$
Range: $y \neq 0$



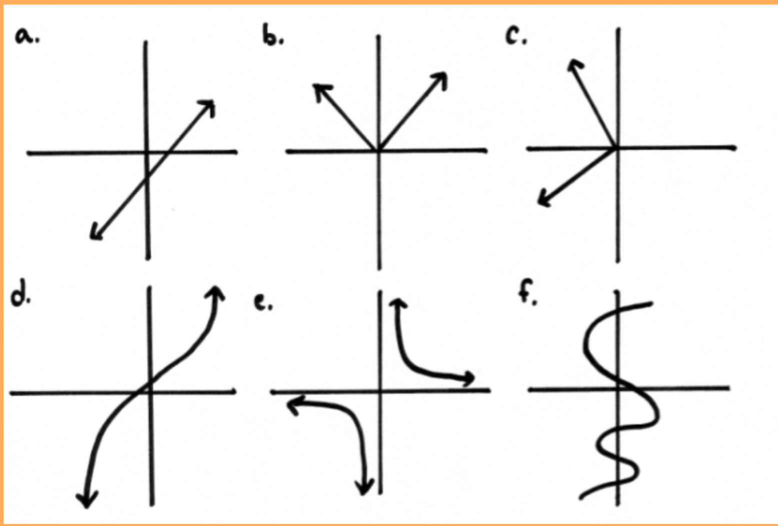
Jan 27-5:01 PM

A vertical line test helps us determine if a graph is a function or not.

Remember, a function has only one y value for every x value.

If a graph is a function, when we draw a vertical line through it, it will only intersect the graph once.

Which of the following are functions?



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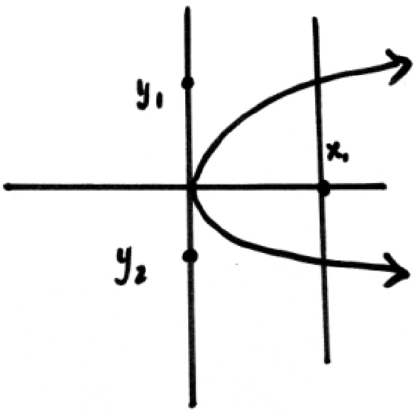
A function is a relationship where for every x value there is only one y value.



Not a function!

There are two y values for one x value.

Jan 27-5:02 PM

Classwork/Homework

Page 172-173 # 20, 21, 22, 23

Use full sentences where written explanations are required!

Page 168-169 # 16

Jan 27-5:10 PM

Answers Pg.172-173 #20, 21, 22, 23

#20
When a vertical line is swept across this graph, it intersects the graph at only one point at any one time, so the graph is that of a function.

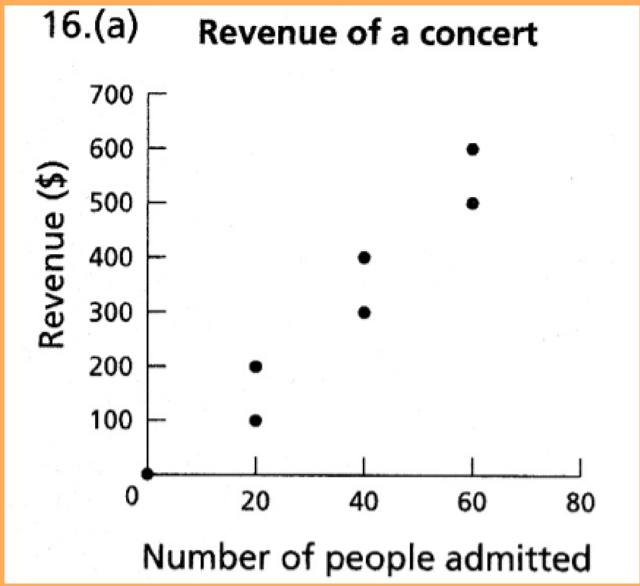
#21
When a vertical line is swept across this graph, it intersects the graph at more than one point in many places, so the graph is not that of a function.

#22
Graphs (a) and (c) represent functions. Graphs (b) and (d) do not represent functions as they do not pass the vertical-line test. For some value of the independent variable there can be more than one value of the dependent value associated with it.

#23
Looking at graphs (e) and (f):
-open dots means that it can not be equal to that value.

Graphs (a), (c), and (e) represent functions.
Graphs (b), (d), and (f) do not represent functions as they do not pass the vertical-line test.

Feb 1-1:49 PM



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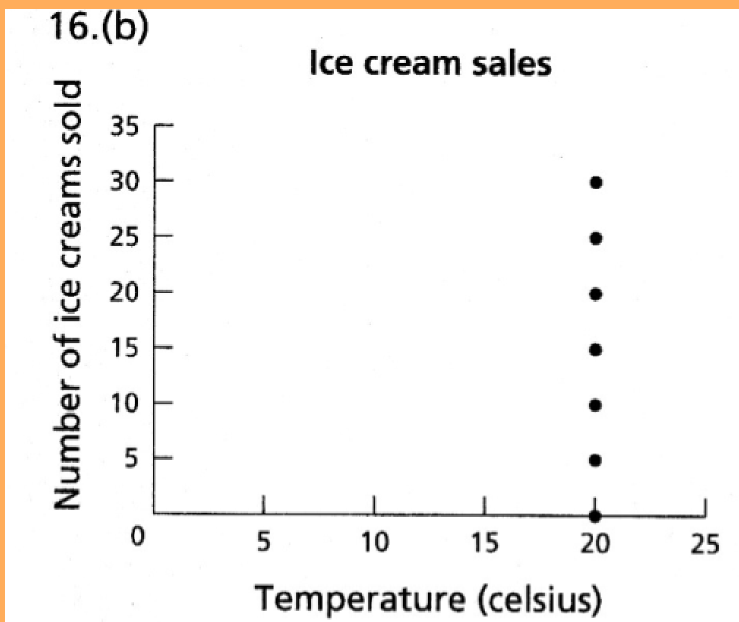

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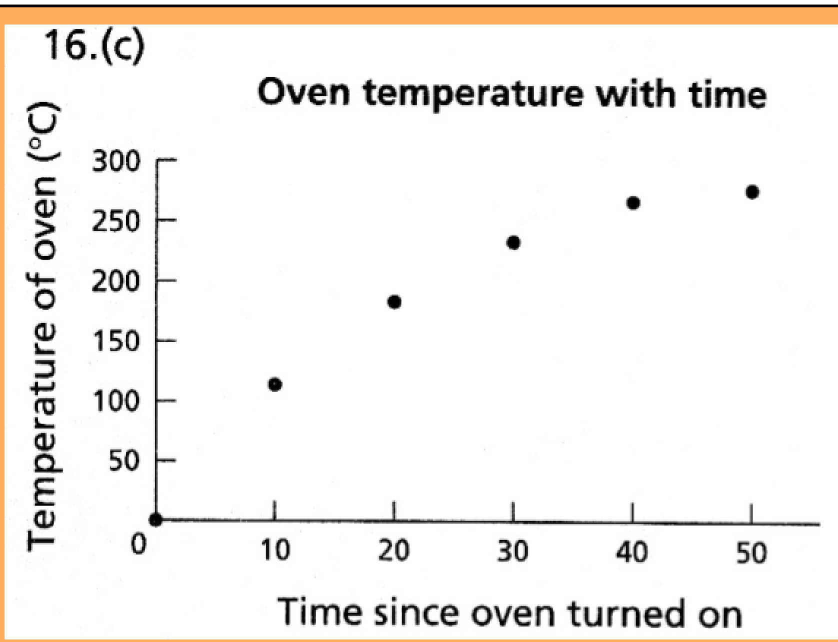

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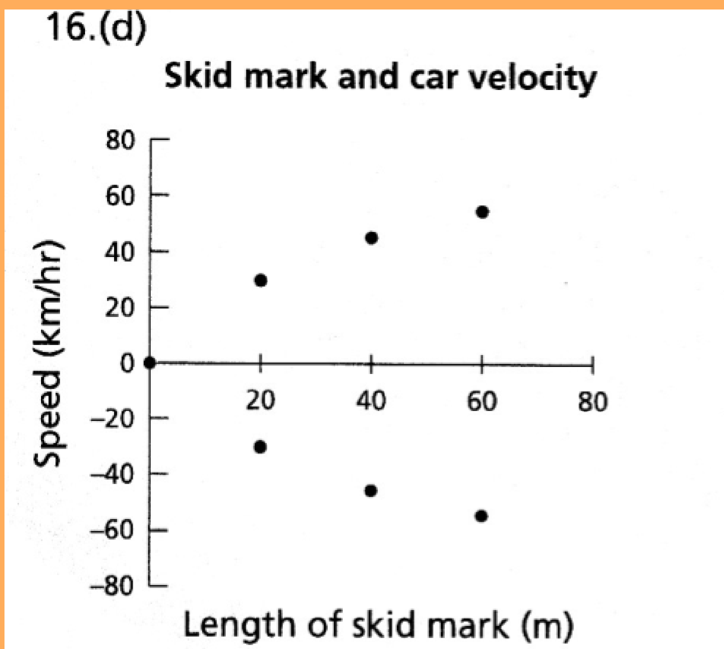

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Function Notation

Function Notation is another way to express an equation. **f(x)** is read as "f of x" or "f at x" and is used when naming functions. Instead of writing $y = x^2$, you write $\mathbf{f(x) = x^2}$. This is called "rewriting the equation using function notation". Simply put, replace the "y" with **f(x)**.

<u>**Example**</u>:
Bella is mowing lawns for the summer. Her earnings are calculated by the equation y = 5x + 10, and is based on how many hours she works. This means that her earnings are a **function** of how many hours she works.

The equation written using **function notation**: **f(x) = 5x + 10**
Write a relation to represent her earnings as a function of hours worked:
e(h) = 5h + 10

If she works 10 hours, how much does she make? e(10) = ?

e(h) = 5h + 10
e(10) = [redacted]
e(10) = [redacted]

If she earns $100, how many hours did she work? e(?) = 100

e(h) = 5h + 10
[redacted]

What is the base amount of money she earns (working no hours)? e(0) = ?

e(h) = 5h + 10
e(0) = [redacted]
e(0) = [redacted]

Feb 7-11:37 AM

Function Notation

<u>Function notation</u> is how we write functions when we are not graphing them.

f(x) = 3x + 2 f(x) is read as "f of x"

When an equation is written as f(x) in place of the y, we know that it is a function.

f(x) = 3x + 2

What does f(2) equal?

Jan 27-5:10 PM

Try These:

$f(x) = 3x^2 + 2x - 1$

a) What does f(2) equal?
b) What does f(-3) equal?
c) What does f(r) equal?

Jan 27-5:09 PM

Classwork/Homework

Page 169 #13 and 15

Jan 27-5:10 PM

Answers Pg. 169 #13 and 15

#13

a) $d(3) = 63$

b) $f(-1) = -1$ $f(2) = 14$

c) $g(-2) = 12$ $g(1) = 6$

d) $T(2) = 117.6$

e) $A(10) = 1967.15$

f) $P(4) = 16$

#15

a) $T = 40/3$

b) $T = 200$

c) $s = 12$

d) $x = 24$

e) $L = 35$

Feb 1-2:06 PM